

Plymouth Harbor, Massachusetts Detailed Project Report

Navigation Improvement Project



April 1990



**US Army Corps
of Engineers**
New England Division

**NAVIGATION IMPROVEMENT STUDY
PLYMOUTH HARBOR, MASSACHUSETTS**

**DETAILED PROJECT REPORT
NAVIGATION PROJECT**

**U. S. Department of the Army
Corps of Engineers
New England Division
APRIL 1990**

SYLLABUS

This Detailed Project Report provides information about a study initiated at the request of the town of Plymouth Selectmen and performed under the special continuing authority contained in Section 107 of the River and Harbor Act of 1960, as amended. The study investigated a variety of navigation improvements to reduce damages and delays to commercial and recreational boaters in Plymouth Harbor, Massachusetts.

The problems confronting Plymouth Harbor are similar to those of other shorefront communities in southern New England, namely that the construction of moorings and slips have failed to keep pace with the growth of boating. The existing Federal and State anchorages in the harbor are at full capacity. There is a waiting list of over 400 commercial and recreational boats for available slips and moorings. It has been estimated that 21 commercial lobster and tuna boats incur damages and operational delays due to the lack of available safe anchorage areas. Total annual fishing delays and damages attributed to the harbor's lack of additional moorings are valued at \$54,700.

This report describes the plan formulation process which developed and evaluated possible harbor improvement alternatives. Each alternative was assessed in terms of its effectiveness, efficiency, completeness and acceptability to the public. Two alternative harbor improvement plans were evaluated (see Table 1 page 12). Of these alternatives, two structural plans, the development of a 10 acre or 5.5 acre anchorage areas were found to merit further detailed study. These anchorage areas would provide for the mooring of 21 commercial lobster and tuna boats and 13 lobster boats respectively. The total first costs for these plans are \$1,053,000 for the 10 acre anchorage and \$677,500 for the 5.5 acre anchorage.

The economic analysis of both plans yielded benefit-cost ratios (BCR) of 0.54 for the 10 acre anchorage and 0.47 for the 5.5 acre anchorage. Because the BCR for all of the alternatives studied was less than unity, Corps of Engineers participation in a navigation improvement project at Plymouth Harbor is not possible since the alternatives lack economic justification.

PLYMOUTH HARBOR, MASSACHUSETTS NAVIGATION PROJECT

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PLYMOUTH HARBOR, MASSACHUSETTS NAVIGATION PROJECT

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DETAILED PROJECT REPORT

NAVIGATION IMPROVEMENTS

PLYMOUTH HARBOR, MASSACHUSETTS

I. INTRODUCTION

This Detailed Project Report (DPR) contains the results of an engineering and economic feasibility study of navigation improvements in Plymouth Harbor, Massachusetts. This study was initiated in response to a request from the Town of Plymouth Selectmen. The selectmen requested a Corps of Engineers investigation to determine if an additional anchorage area to improve navigation was warranted. This study utilized information obtained from the Town of Plymouth and concerned fishermen.

The town of Plymouth is located in southeastern Massachusetts about 35 miles south of Boston and about 18 miles north of the Cape Cod Canal (see Plate 1). The harbor is extensively used by recreational boaters and commercial fishermen for both anchorage and marine services.

This study examined the economic justification of providing navigation improvements in Plymouth Harbor. The first study phase consisted of a reconnaissance investigation which determined that further Federal study in providing navigation improvements to Plymouth Harbor was warranted. The reconnaissance report concluded that initiation of a detailed feasibility study was justified. This DPR presents the findings and recommendations of the feasibility study which examined alternative plans of improvements to existing conditions in the harbor.

Study Authority

This DPR was prepared under the special continuing authority of Section 107 of the 1960 River and Harbor Act, as amended.

Scope of Study

The geographic scope of this study centers at Plymouth Harbor which includes Hob's Hole and Goose Point Channels, Long Beach and adjacent areas including proposed disposal sites. This study was performed at the level of detail required to permit optimum plan selection and determination of feasibility.

The scope of the study included the following:

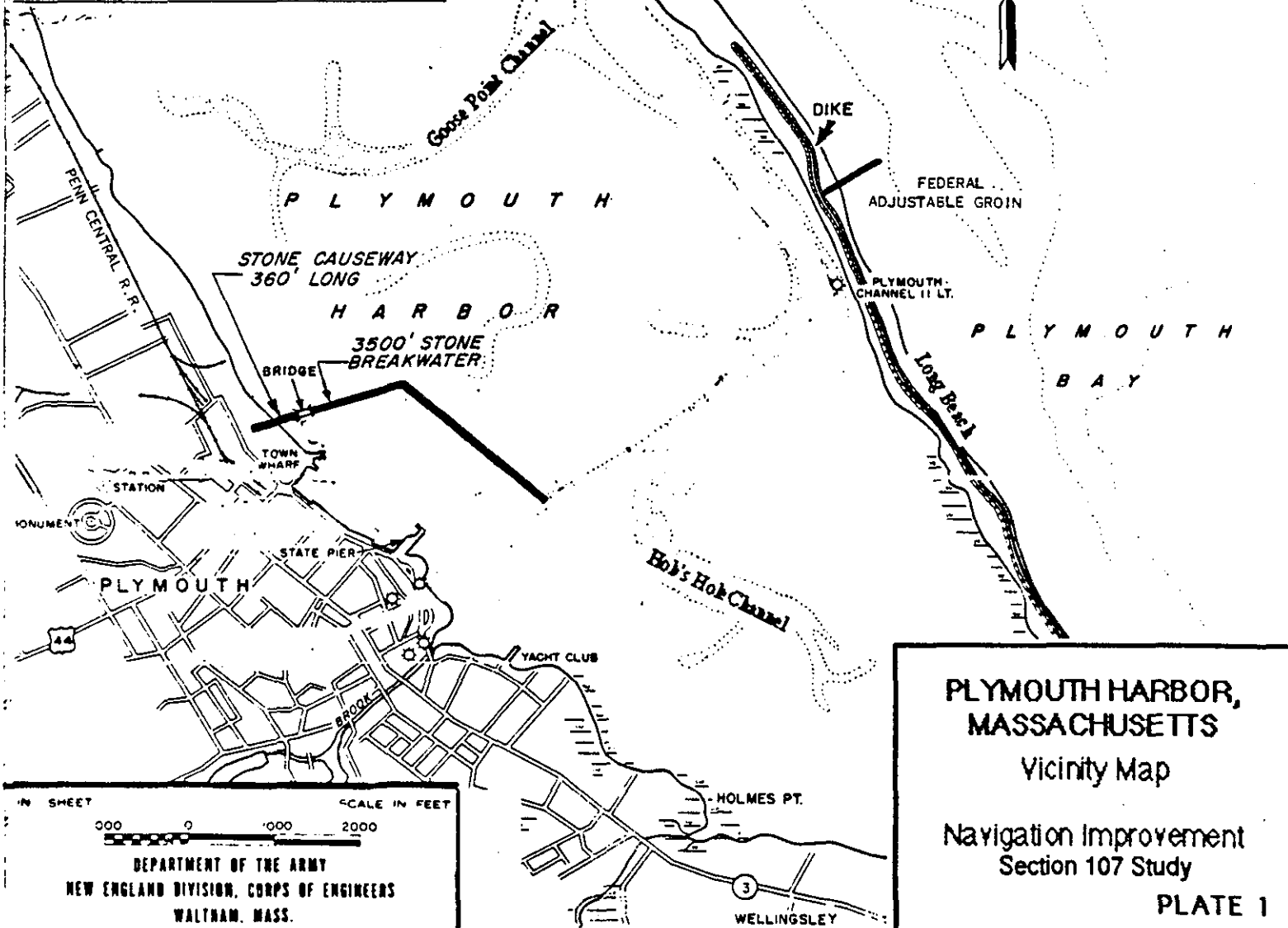
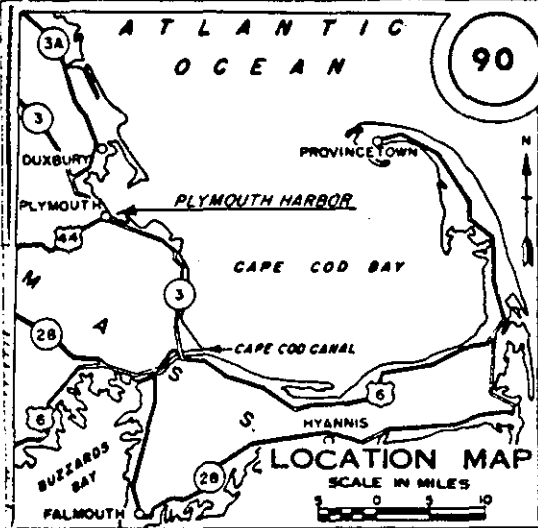
- Determination of the navigational problems and needs of the area;
- Gathering information and preparation of aerial maps;
- Identification of existing conditions and historical trends;
- Holding meetings with the public to coordinate the formulation, evaluation and determination of support of various solutions;
- Determination of the most probable future condition without Federal Navigation Improvements;
- Evaluation of the engineering, environmental, economic and social effects of alternative plans with respect to existing and future conditions;
- Recommendation of improvements which were found to be economically and engineeringly feasible, environmentally acceptable and socially beneficial in accordance with appropriate legislation and current Federal policy.

Study Participants and Coordination

Close coordination and cooperation between the Corps of Engineers and other Federal agencies, state agencies, Plymouth officials, local commercial fishermen, sport fishermen, businessmen and interested individuals was maintained throughout the investigation. Public involvement was actively pursued. Numerous meetings with local officials and other interests were held to obtain information directly from the prospective users. Based on information obtained, planning objectives and constraints were identified. See Appendix 2 for pertinent correspondence.

As the Corps' study effort progressed, meetings were held with local fishermen, concerned citizens, town officials and the Massachusetts Office of Coastal Zone Management and the Division of Waterways to explain harbor improvement options under investigation. Participants were sent copies of communications the Corps received concerning the study, and were invited to provide their comments and ideas.

All studies were made in a sufficient level of detail to permit optimum plan selection and determination of its feasibility. Interagency coordination and public involvement helped shaped a plan that would reduce both delays and damages associated with navigating Plymouth Harbor while maintaining one of the town's economic mainstays, commercial fishing.



IN SHEET

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

The Report and Study Process

The initial steps in this study included a comprehensive inventory of available information, performance of hydrographic surveys, environmental sampling and testing. Extensive efforts were expended in contacting public officials to provide information and seek input to the study process. Based on these efforts, planning objectives and constraints were identified and alternative plans formulated. These plans were developed and evaluated in coordination with state and local authorities. Final conclusions and recommendations were then developed.

This report consists of a main report and three appendices. The report summarizes the planning process and presents the findings of various efforts performed to best evaluate the proposed alternative plans of improvement as well as the Division Engineer's recommendation. Appendix 1 is the Economic Analysis. This appendix assesses the the annualized benefits to the commercial fishing fleet that would be derived from implementation of the alternative plans of improvement. Appendix 2 contains pertinent correspondence and Appendix 3 includes the results of physical testing performed on sediment cores taken from various locations within Plymouth Harbor.

Prior Studies and Improvements

Federal: The Federal Government currently maintains several navigation improvement projects in Plymouth Harbor. These improvements were first authorized in 1825 and were amended through 1885. These improvements consisted of protecting Long Beach, thereby preventing the inner harbor facilities from being destroyed, and dredging a channel in the inner harbor and a basin in front of the town wharf, to a depth of 9 feet (ft.). The work was completed in 1893.

The existing project was adopted in March of 1899, supplemented by Congressional Acts of 1913, 1922, 1938, 1962, and further modified by the Chief of Engineers on 22 November 1965. These completed projects provide for the following:

1. A riprap dike protecting sections of Long Beach and restoring the Eel River to its former course. This project was completed in December 1971.
2. A Federal Channel 18 ft. deep and 200 ft. wide, increased at the entrance and curves, from the bay to the town wharves, formerly in the area south of the State Pier, a distance of about 2.5 miles, with a suitable turning basin at the inner end.
3. A Federal Channel 15 ft. deep and 150 ft. wide, extending in a northwesterly direction about 1/3 of a mile from a point off the site of northerly Craigs Wharf (now the State Pier) with a turning basin 300 ft. square and of the same depth at its northwesterly end.

4. A stone breakwater extending 1,400 ft. easterly from a point north of the Town Wharf, and thence southeasterly for a distance of 2,100 ft.; an anchorage 8 ft. deep and 60 acres in area inside the breakwater. Also provides for elimination of the previously authorized but never constructed anchorage in the lee of Long Beach.

Other Developments: The town of Plymouth has developed and improved the inner harbor shoreline. The availability of docks, wharves, parking facilities, marinas, boat yards and other businesses offering marine services have kept Plymouth Harbor a convenient boating location. The Commonwealth of Massachusetts has dredged 7 foot, 15 foot, and 6 foot deep anchorages at the western, southwestern and southern flanks respectively of the inner end of the Federal channel. The major features and improvements by both Federal and non-Federal interests are shown on Plate 2.

II. PROBLEM IDENTIFICATION

This portion of the report discusses the nature and scope of the problems necessitating harbor improvements, and establishes planning objectives and constraints that direct subsequent tasks for the study, assuming no new navigation improvement project is constructed. Alternatives presented later in this report are assessed and evaluated by comparing them to this "without project" condition.

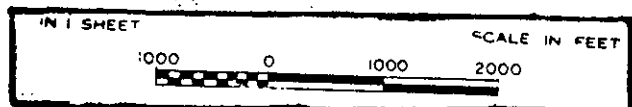
Existing Conditions

The area of Plymouth Harbor is approximately 2,000 acres. The harbor is formed by Long Beach, a low narrow sand spit 1.8 miles long which generally parallels the mainland (see Plate 2). The entrance to the harbor lies at the northerly end of Long Beach. The harbor's mean tidal range is 9.6 ft.

Development/Economy: Plymouth is the oldest town in New England. In 1620, the Pilgrims landed and established the first settlement here. Navigation, agriculture and commerce comfortably supported the inhabitants of this area for many years. During the 1800's over 100 ships were engaged in coast-wide fishing and trade. Today, Plymouth is both a tourist center and a summer resort, accommodating many tourists as well as seasonal residents. The service industry is the largest source of employment for the township employing over 30% of the total work force. About 2% of the population is currently employed in the fisheries industries. Most of the fish caught by Plymouth fishermen are sold to local restaurants and tourists.

CAPE COD BAY

DUXBURY PIER LT.



PLYMOUTH CHANNEL 4 LT.

0.0 MI.

0.4 MI.

FEDERAL JETTY

DIKE

1.0 MI.

FEDERAL ADJUSTABLE GROIN

PLYMOUTH

STONE CAUSEWAY
360' LONG

3500' STONE
BREAKWATER

EXISTING
18'-CHANNEL
(FEDERAL)

PLYMOUTH CHANNEL 11 LT.

1.5 MI.

BRIDGE

8'-ANCHORAGE

2.0 MI.

EXISTING 15'-CHANNEL
& TURNING BASIN
(FEDERAL)

TOWN WHARF

R.R. STATION

7'-BASIN
(STATE)

2.5 MI.

PLYMOUTH

15'-ANCHORAGE
(STATE)

6'-BASIN
(STATE)

YACHT CLUB

BROOK

44

PLYMOUTH HARBOR, MASSACHUSETTS

Existing Federal & State
Harbor Improvements
Section 107 Study

PLATE 2

POVERTY
ET.

Plymouth Harbor has become one of the busiest historic and tourist centers in the State. The harbor contains a State pier, a private pier owned by a marina with slips for recreational boats, Federal and State anchorages, a Federal channel and a Federal breakwater. There are three fish wholesalers located in Plymouth Harbor at the town wharf and one wholesaler located at Manomet Point to the south.

Terminal and Transfer Facilities: Terminal and transfer facilities include 30 and 40 ton travel lifts, 6 and 10 ton cranes, two piers including the town pier which is available year round free of charge, and two marine railway facilities capable of accommodating vessels up to 100 ft. in length.

Navigation: There are nearly 700 boats moored in the harbor, of which just over 600 are recreational boats, 66 are commercial fishing boats and 10 are party/tour boats. The existing Federal and State anchorages in Plymouth Harbor are full to capacity.

Plymouth Harbor's recreational fleet consists of about 500 boats that are moored in existing anchorage areas, and 100 boats are located at slips at a private marina. The recreational fleet has a power-to-sail ratio of 60/40. The average boat length is 27 ft.. Recreational boaters waiting for moorings currently either moor in other harbors or trailer their boats. The potential for growth of the recreational boating industry in the harbor is presently thwarted by the limited numbers of anchorages. The present recreational boating season lasts about 30 weeks, from early April through late October. The heaviest traffic and visits by cruising transient craft are experienced from June to September.

Plymouth Harbor's commercial fishing fleet consists of 25 draggers and 41 lobster boats. The draggers berth at the town wharf while the majority of lobster boats single point moor throughout the harbor. The draggers average 55 ft. long with a loaded draft of 8 ft. and the lobster boats average 35 ft. long with a loaded draft of 4.5 ft. The commercial fishing boats in Plymouth Harbor are primarily day boats, although approximately 1/3 of the draggers and several of the lobster boats stay out for several days to two weeks at a time.

The Harbormaster manages a waiting list for moorings of almost 400 recreational boats and 21 commercial fishing boats. Although there is a significant number of boats awaiting moorings, the harbor is not overly congested or crowded since boat owners that request moorings are placed on the waiting list and assigned moorings spaces as they are vacated. Since boats remain moored in the harbor for many years, there is limited turnover of mooring spaces for boats on the waiting list.

Commercial fishermen on the waiting list for moorings in Plymouth Harbor are currently in one of two groups: those who anchor in a non-anchorage area in a naturally existing channel in the east section of the harbor called "Hob's Hole Channel"; and those who moor their boats in other harbors. These vessels are primarily either lobster or tuna boats. Thirteen commercial lobster vessels awaiting moorings anchor in Hob's Hole Channel. These boats frequently experience grounding damages and tidal delays. The channel is very narrow and long, with depths ranging from 9 to 14 ft. but bordered on all sides by much shallower areas 1 to 2 ft. deep. During periods of strong winds, boats swing on their anchor out of the channel into the shallow area, bumping or grounding out, thereby incurring damages. Access to the channel is limited at low tide, resulting in occasional tidal delays to both in-coming and out-going vessels. These tidal delays occur an estimated 8 times per month and last approximately 2 to 3 hours each.

The remaining 8 of the 21 fishermen on the waiting list live in the immediate Plymouth area and would prefer to moor their boats in Plymouth Harbor but, because of the lack of anchorage, moor their boats in either Sandwich or Green Harbor in Marshfield, Massachusetts. Both these harbors are between 15 and 20 miles from Plymouth, necessitating additional driving time and fuel expense.

Future Conditions if No Federal Action is Taken

Without Federal involvement in navigation improvements, the existing conditions and trends, as previously described, will continue in Plymouth Harbor. Increased repair costs, down-time and tidal delays will result in an increase cost to the commercial fleet at Plymouth Harbor. Lastly, the nearly 600 recreational boats on the waiting list will continue to be required to trailer their boats or moor at other less conveniently located harbors. The harbor's potential opportunity for growth as either a recreational or commercial fishery resource would not be fully realized.

Problems, Needs & Opportunities

Plymouth Harbor's major navigation problem is a lack of available protected anchorage. This has restrained expansion and development of its commercial and recreational boating industries. Due to this lack of moorings 13 commercial lobster boats are forced to moor in Hob's Hole channel. The lobstermen have experienced damages to their hulls and gears as wave action moves their vessel's keel across the harbor bottom. In addition to these damages, the commercial fishermen who are forced to moor at distant harbors together with the lobstermen who moor in Hob's Hole channel have sustained fishing delays. These delays account for increased fuel and labor costs for the lobstermen.

The Federal objective of water and related land resources project planning is to contribute to National Economic Development (NED) consistent with protecting the Nation's environment pursuant to national environmental statutes, applicable executive orders and other Federal planning requirements. Economic justification criteria requires that annual benefits, due to the navigation improvements, exceed the annualized economic costs of those improvements. The proposed project should reasonably maximize net annual benefits. Corps financial participation is limited to the level of development of the plan which maximizes net benefits. One plan, called the NED Plan, must be formulated, consistent with Federal objectives. Other plans may be formulated which have less net NED benefits in order to further address other Federal, state, local and international concerns not fully addressed by the NED Plan. All alternative plans, including the NED plan, were formulated in consideration of four criteria: completeness, effectiveness, efficiency and acceptability.

Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to insure the realization of the planned effects. Each plan must be complete within itself to provide the benefits claimed for that plan.

Effectiveness is the extent to which the alternative plan alleviates the specified problems and achieves the specified opportunities.

Efficiency is the extent to which an alternative plan is a cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.

Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public, and compatibility with existing laws, regulations and public policies.

An economic evaluation is based upon the following terms and definitions:

Project First Costs include estimated costs for construction, contingencies, engineering, design, supervision and administration, real estate and mitigation, if any.

Project Investment includes both the Project First Cost and interest during construction on project expenditures until features become operational or begin producing benefits.

Operation, Maintenance and Replacement Costs include all average annual costs estimated for the project after it is constructed to keep it operating and maintained in optimum condition in accordance with provisions prescribed by the Corps. Also included are the average annual costs of major replacements over the project life.

Average Annual Costs include the project investment amortized over a 50 year project life at a current Federal interest rate of 8 and 7/8 percent plus the estimated project annual operation, maintenance and replacement costs.

Average Annual Benefits include that portion of the average annual navigation damages prevented by the selected alternatives plus any other related NED benefits;

Benefit-to-Cost Ratio (BCR) is an indicator of the economic feasibility of the plan which is determined by dividing average annual benefits by average annual costs.

Net Annual Benefits is the difference between average annual benefits and average annual costs.

In order to enhance the physical and social environment of the study area and to avoid creating unacceptable project effects, the following environmental considerations were evaluated:

- To avoid wherever possible the direct loss of vegetated shallows;
- To avoid adversely affecting the water quality of the harbor;
- To avoid creating flows in the navigation channel that exceed 3 knots or 5.1 ft. per second to assure safe passage for navigation;
- To reduce or mitigate any significant adverse effects which cannot easily be avoided.
- To design and develop project features so as to provide opportunities which enhance the environment and recreation in the study area.

III. PLAN FORMULATION

This section describes the alternatives that were studied, the plans that were developed and the process that was used to screen each plan. The formulation and analysis of alternative plans to reduce and or eliminate navigation problems is based largely on careful review of the existing and future conditions as well as the problems, needs and opportunities of Plymouth Harbor. When increases in shoaling or damaging winds and waves occur, substantial damages will continue to be sustained by Plymouth's commercial fishing vessels. Potential methods for reducing future delays/damages within the study area to acceptable levels were evaluated, while taking into consideration the strong state and local interests in retaining the natural appeal and character of Plymouth.

The Federal Objective

The formulation of plans for navigation improvements at Plymouth Harbor is predicated on a standard set of criteria adopted to permit the development and selection of a plan responsive to the navigation problems and needs of the study area. Each alternative is evaluated on the basis of its contribution to the planning objectives. Selection of a specific plan is based on technical, economic and environmental criteria which permits the fair and objective appraisal of the effects and feasibility of alternative solutions.

Technical criteria requires that the optimum plan have the facilities and dimensions necessary to accommodate the expected user vessels with sufficient area to provide for maneuvering of boats and potential development of shore facilities.

All of the problems and needs described in this report: grounding damages, tidal delays, loss of recreational opportunities and increases in transportation and harvesting costs, could be reduced or eliminated by developing a harbor improvement plan that would achieve the objectives of this study.

Planning Objectives & Constraints

The planning objectives for this study were based on an assessment of the problems, needs and opportunities in the study area, as determined by Corps investigation statements, concerns and goals of the affected region. The degree to which the alternative plans meet these objectives, while complying with required criteria, determines which alternative will ultimately be selected.

The objectives of this study are to:

- Reduce the navigation grounding damages in the study area;
- Reduce the navigational delays posed to the commercial fishing fleet;
- Preserve the valuable national resources in the inner harbor area - its vegetated shallows, water quality and navigation;
- Provide an optimum navigation system to efficiently serve the needs of the commercial fishing operations and recreational boating interests now using or potentially desiring to use Plymouth Harbor;
- Preserve and enhance recreational opportunities; and
- Support the objectives of other planning agencies and complement regional long range recreational, environmental protection and commercial fishery development plans.

Planning constraints are those parameters that limit the implementation of any proposed plan of improvement and serve to eliminate from consideration those possibilities that offer no acceptable degree of satisfaction. These constraints can include natural conditions, economic factors, social and environmental considerations, and legal restrictions. The following constraints defined the precise nature of the study:

- Care must be taken to minimize the effect of improvements upon wetland areas located in Plymouth Harbor.

- Sediment removed from Plymouth Harbor could contain certain pollutants which may have an adverse effect upon the environment. Any land or ocean disposal site must be selected so as to restrict the release of possible pollutants beyond the boundaries of the site.
- Current Massachusetts state policy directs that any dredging operation for navigation improvements be utilized as beach nourishment, provided the material is compatible.
- Alternatives considered should not unduly encroach upon planned harbor improvements. Evaluation of alternatives will consider local, state and Federal laws affecting the development within the study area.
- In order for Plymouth Harbor commercial fishing interests to maintain suitable stable markets for their catch, they must be able to deliver a constant supply. Any disruption of commercial operations could discourage some buyers from doing business with Plymouth's fishing concerns. Therefore, the selected plan for harbor improvements must entail minimal interference with commercial fishing operations in the harbor.
- Tourism is Plymouth's major industry, and its seaside charm. Recreational boating activities are extremely important to this community. Construction of any improvements during the height of the tourist-recreational boating season could discourage these activities through a temporary adverse effect on the aesthetic value of the harbor. Therefore, construction activities should be scheduled so as to avoid major activity during the height of the tourist season which extends from mid-May to mid-September.
- Evaluation of alternatives should consider local, State and Federal laws affecting the development of the study area.

Concerns which exist that are not specifically quantifiable, to be considered as constraints, are as follows:

- Costs applicable to any new proposed improvements must be fully coordinated with the town to assure that cost sharing requirements will be within the Non-Federal financial capabilities.

- The intertidal area is that portion of the harbor which lies between the mean high waterline and mean low water. Any offshore harbor navigation improvement project should be evaluated so that the project effects on the intertidal area maybe anticipated and addressed.

Analysis of Alternatives

Various combinations of structural and non-structural alternatives were evaluated as to their capacity to solve the navigation problems in the inner harbor. Each measure was investigated to determine economic and engineering feasibility, associated environmental and social effects of implementation and the public attitudes. A number of navigation improvement alternatives were developed and analyzed during the early stages of this study. These alternatives included various dredging options and the transfer of the commercial vessels experiencing grounding damages and tidal delays to neighboring ports. In the reconnaissance study phase, four alternative plans were identified for evaluation:

1. ***Dredge additional anchorage areas within the harbor;***
2. ***Reorganization of existing moorings within the harbor to better accommodate the existing fleet;***
3. ***Transfer of vessels to other nearby ports;***
4. ***No action plan - Maintain present conditions in Plymouth Harbor.***

1. ***Dredge additional anchorage areas within the harbor*** - This plan involves the dredging of additional anchorage areas to more efficiently accommodate the existing fleet and to provide additional room for the expected commercial fleet transfer to Plymouth Harbor. A project to provide additional anchorages was found viable and warranted further detailed study.

2. ***Reorganization of existing moorings*** - This plan involves the reorganization of existing moorings to more efficiently accommodate the fleet within the existing anchorage areas. Possible mooring alternatives could include abolition of the existing single-line/free-swing mooring pattern and implementation of two or four line mooring systems. Other mooring alternatives can be identified such as private construction of slips or storage racks for smaller vessels. Such reorganization plans were found to also warrant further study.

3. Transfer of vessels to other nearby ports - This plan consists of relocation of a portion of the operations of the commercial fleet to other harbors in the area that may be better suited to the needs of these fishermen. Harbors considered, within a 15 mile radius of Plymouth Harbor, include Provincetown, Scituate, Duxbury and Marshfield. This alternative also warranted further study.

4. No Action - Without Federal involvement in providing navigation improvements to Plymouth Harbor, congestion and conflicting activities of recreational and commercial interests at the harbor's available anchorages will continue. Future demand for moorings by both commercial and recreational interests is not expected to increase significantly but will remain strong. This future condition is due to the limited opportunities for new marina developments and/or additional shore facilities to attract additional boats to Plymouth Harbor. For these reasons a no action response is unacceptable.

The plan formulation process involves the development and evaluation of those management measures described in Table 1. Each measure was assessed in terms of its effectiveness, efficiency, completeness and public acceptability. Alternatives that did not address the problems and opportunities of Plymouth Harbor were eliminated. Plans were designed to achieve the national objectives and meet the problem and opportunity statements developed for the harbor. State and local objectives were also considered in the evaluation of alternative plans.

TABLE 1

**Plymouth Harbor, Massachusetts
ALTERNATIVE HARBOR IMPROVEMENTS**

I. Structural

- A. Provide a 10 acre anchorage area
- B. Provide a 5.5 acre anchorage area

II. Non-Structural

- A. Harbor Management Plan
- B. Relocation

I. Structural. The opportunity exists to provide additional anchorages, for safe and efficient utilization of Plymouth Harbor by both the commercial fishing and recreational boating interests and to provide for maintaining these economically important industries. All of the problems previously described, lobster boat tidal groundings and delays, and the additional commercial and recreational boats desiring to use the harbor could be reduced or eliminated by the construction of additional anchorage areas. Conceptual anchorage areas were discussed with the Harbormaster.

It was determined that the only practical location for a new anchorage area would be just east of the existing State 6 foot mooring basin and alongside of the Federal Channel. This location was chosen by the fact that no other protected locations of adequate size were available in the harbor. Provision of a Federal anchorage would provide for the existing single point moored lobster boats that are awaiting moorings.

Based on the sizes and classes of vessels presently in use in Plymouth Harbor, it was determined that an anchorage depth of -8 ft. at MLW would be sufficient. This determination was made after consideration of the average design lobster boat dimensions, wave heights in the protected harbor and allowances for pitch and squat while underway. This depth would eliminate all tidal delays and damages for the lobster boats that currently desire moorings in Plymouth Harbor. Dredging quantities derived for various alternatives were based on the Corps hydrographic condition surveys conducted in 1978 and 1983.

The commercial fleet awaiting moorings is composed of 21 vessels which are either tuna or inshore lobster boats. Currently 13 lobster boats are single point moored in Hob's Hole Channel. The inshore boats will occasionally travel further to land other species of fish, such as fin fish, crabs and other shellfish. Landings are usually made at either the State or town piers. The catch is then transported by truck to wholesalers. Estimates of landings and use practices were determined through consultation with the Harbormaster and local fishermen.

All structural alternatives are complete within themselves, providing access to the ocean at all tidal stages for the types of craft they are designed to serve. In an effort to reduce the cost of dredging, the intertidal areas of the harbor were eliminated from consideration. Two methods of dredging considered for this project were mechanical and hydraulic dredging. Mechanical dredging was selected over hydraulic dredging since the material from the harbor bottom is made up of fine graded material (over 70% silts & clays). The grain size of the harbor bottom material is not compatible with the existing beach material found to the north, the south, or offshore along Long Beach. In addition there were no upland sites in close proximity to Plymouth Harbor suitable whereby the dredged material could be hydraulically pumped to.

A) Provide for a new 10 acre anchorage: This alternative would eliminate Plymouth Harbor's waiting list back log of commercial lobster and tuna boats. A 10 acre anchorage area would need to be dredged to -8 ft. MLW to safely accommodate 21 boats (13 vessels moored in Hob's Hole Channel and 8 vessels requesting transfer to Plymouth from other harbors). Over 97,200 cubic yards (c.y.) of material would be removed and disposed of at the Foul Area open water disposal site, which is approximately 35 miles northeast of Plymouth Harbor. The total estimated first cost for this anchorage is approximately \$1 million.

B) Provide for a 5.5 acre anchorage: It was determined that an anchorage depth of -8 ft. at MLW would be sufficient for all of the lobster boats on the waiting list who currently experience mooring problems in Hob's Hole Channel. This plan would provide safe anchorage for thirteen lobster boats, based on single point mooring (average length of boats, 35 ft.). Over 54,400 c.y. of dredged material would be removed and disposed of at the Foul Area. The total estimated project first cost for this anchorage would be \$677,500.

Locations of alternative plans A and B are shown on Plate 3. Following the initial dredging of the anchorages shoaling or filling would occur because of settlement of material from side slopes, deposition of material from upland erosion and from current and tidal action. Propeller wash and waves produced by passing vessels would also tend to disturb the bottoms of the anchorages, resulting in redistribution of bottom sediments.

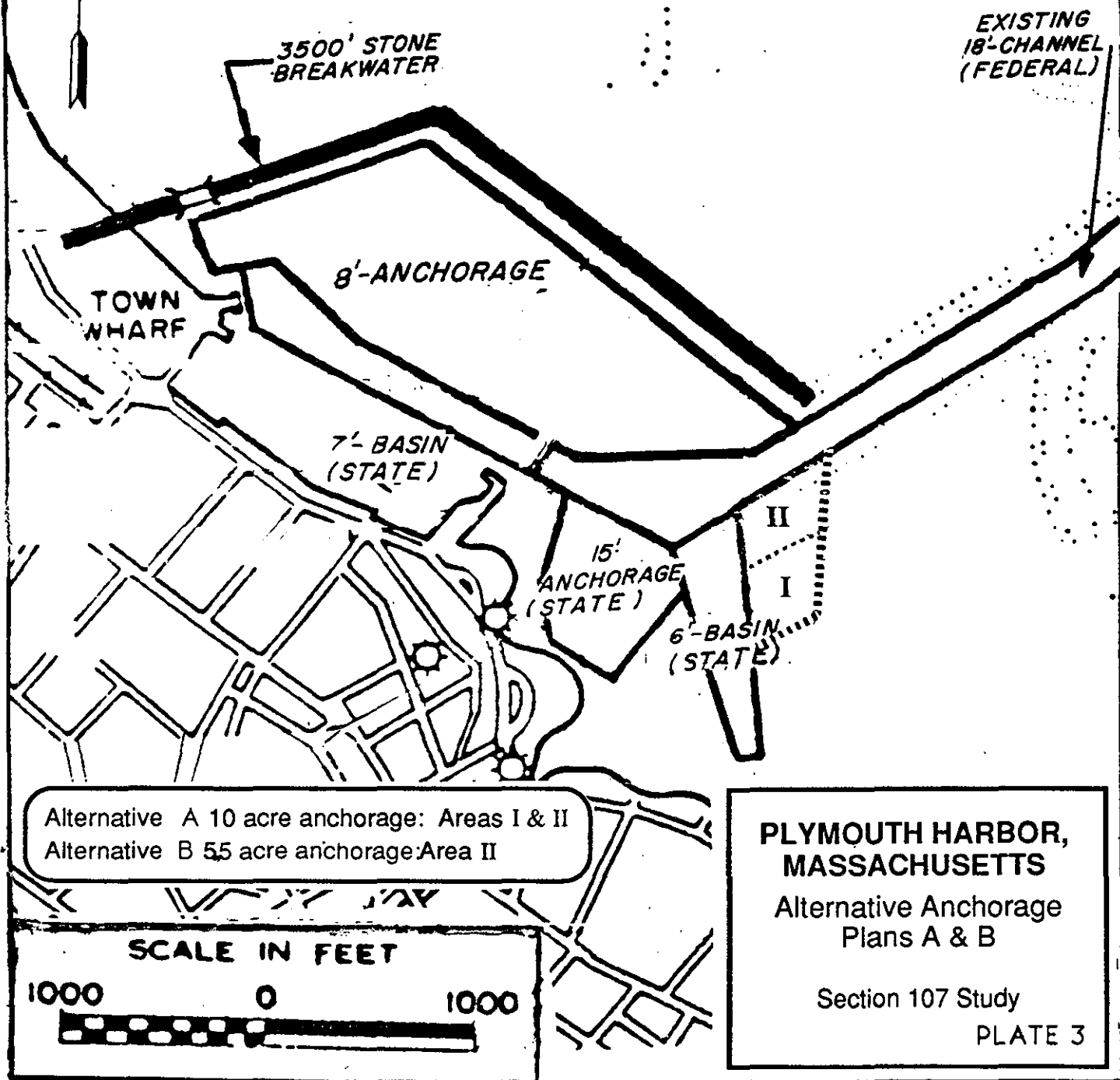
Plymouth Harbor is subjected to strong tidal currents which scour the existing anchorages. From historical data of maintenance dredging operations, throughout the harbor, it is projected that deposition of sediments within the alternative anchorage areas is estimated not to exceed an annual rate of 3 percent of the total volume to be removed for each alternative plan. As depths within the areas are progressively diminished by shoaling, the efficiency of the anchorages would be gradually reduced. Maintenance dredging would become necessary to prevent a severe reduction in the anchorages efficiency which would begin to occur when shoals over the entire project area reached levels of 2 ft. above the original dredge depth. This would occur about once every 20 years for each of the anchorage areas.

II. Non-Structural

A) Relocation: This solution would entail transferring excess existing and potential commercial fishing operations to nearby ports. Plymouth Harbor is one of many boat harbors located along a 45 mile stretch of coastline between Boston Harbor and the Cape Cod Canal.

Relocation of a portion of the commercial fleet to other harbors in the area was not considered an acceptable alternative in solving the problems of Plymouth Harbor, for the following reasons: (1) The town has improved facilities at the town pier to adequately support and maintain the economic vitality of Plymouth Harbor for commercial fishing. The existing commercial fishing fleet based at Plymouth Harbor is economically viable and has potential for growth with the support of the shore facilities at the town pier. (2) Through conversations with officials at other nearby harbors, it was determined that transferring surplus commercial and or recreational craft to nearby ports is impractical. The same overcrowded conditions which exist at Plymouth also exist in nearby ports due to the substantial increases in commercial and recreational boating over the past twenty years.

PLYMOUTH HARBOR



All ports along the coastline between Boston and the Cape Cod Canal are further from those areas fished by the Plymouth boats. These ports lack available anchorage to satisfy their own existing demands. Green Harbor to the north is a river harbor with little anchorage space. The ports of Scituate and Hingham are not within a reasonable range of the Plymouth lobstering grounds. In addition, these ports could not accommodate the increased traffic during the summer months when recreational vessels crowd into all available harbors of Cape Cod Bay. Since Plymouth's commercial fishing fleet is mostly composed of inshore lobster boats, transfer to more distant ports would not be cost-effective for the fishermen.

B) Harbor Management Plan: Overcrowding during the recreational season has restrained industry growth trends for the recreational fleet while also adversely affecting twenty-one commercial fishing boats. The Harbormaster stated that the predominate method of mooring in the harbor is single-point mooring. Due to the wave heights in the harbor, two or four point moorings are inadequate since waves overtop the sides of smaller boats. Since the harbor is moored at capacity and there are no other mooring alignment options available, the reorganization of existing moorings would have no effect in increasing the amount of moorings in the harbor. Therefore, reorganization is not considered to be a viable alternative.

There are no feasible means to accomplish the project objectives by implementation of non-structural solutions due to the constraints and objectives placed on the project. The development of new anchorage facilities at Plymouth is considered to be the more satisfactory means of meeting the needs and desires of the harbor.

IV. COMPARISON OF DETAILED PLANS

Project Costs

Costs of the alternative anchorage plans are based on estimates of current charges and rates for the volumes and types of material expected to be encountered and assuming ocean disposal of the dredged material. Table 2 provides estimated costs and annual charges for alternative plans A and B. Varying price per cubic yard for maintenance activities for each alternative is determined based on the volume of material being removed. This unit price is then multiplied by the annual shoal quantity to determine the annual cost of maintenance dredging for each plan.

TABLE 2

**PLYMOUTH HARBOR, MASSACHUSETTS
ANCHORAGE ALTERNATIVES
TOTAL COSTS AND ANNUAL CHARGES**

	Plan A (10 Acre)	Plan B (5.5 Acre)
Dredging & Disposal Ordinary Material	\$748,400	\$470,600
Contingencies (25%)	<u>+187,100</u>	<u>+117,400</u>
Total Construction Cost	\$935,500	\$588,000
Engineering & Design	43,000	38,500
Supervision & Administration	<u>+75,000</u>	<u>+51,000</u>
*Total Project First-Cost	\$1,053,500	\$677,500
Interest & Amortization (50 years. @ 8-7/8%)	\$94,800	\$61,000
Annual Maintenance Dredging	<u>+5,000</u>	<u>+3,000</u>
Total Annual Cost	\$99,800	\$64,000

*Estimated construction period less than 1 month;
Interest During Construction not factored into estimate

Project Benefits

The benefit analysis aims to measure the net beneficial contributions to National Economic Development (NED) associated with each of the alternative plans for harbor improvements. The benefit categories in this study are:

- 1) Elimination of grounding damages to lobster boats
- 2) Labor time savings by eliminating tidal delays to lobster boats
- 3) Fuel cost savings by eliminating tidal delays to lobster boats
- 4) Over land travel time delays
- 5) Over land transportation cost savings

Each of the alternative plans provide varying degrees of benefits to the commercial fishery interests. The 10 acre anchorage alternative would combine all benefit categories, while the 5.5 acre anchorage would only benefit categories 1 through 3. Table 3 illustrates the average annual benefits attributed to each benefit category.

TABLE 3

**PLYMOUTH HARBOR, MASSACHUSETTS
ANNUAL BENEFITS**

ANNUAL BENEFIT	CATEGORY
1) Elimination of grounding damages to lobster boats	\$3,500
2) Labor time savings by eliminating tidal delays to lobster boats	23,100
3) Fuel cost savings by eliminating tidal delays to lobster boats	3,400
4) Over land travel time delays	16,400
5) Over land transportation cost savings	<u>+8,300</u>
TOTAL ANNUAL BENEFIT	\$54,700

For a further discussion of the potential benefits associated with each alternative harbor improvement plan, please refer to Appendix #A, Economic Analysis.

Selected Plan Evaluation

When comparing the annual cost with the annual benefits accruing to the alternative plans, it was found that all of the alternatives studied were not economically feasible, as the costs exceed the benefits. Table 4 shows the economic evaluation of the plans.

TABLE 4

**PLYMOUTH HARBOR, MASSACHUSETTS
Economic Evaluation of Alternatives**

Alternative	Annual Benefits (\$000)	Annual Costs (\$000)	Benefit/Cost Ratio	Net Benefits
10 acre anchorage	54.7	99.8	0.55	None
5.5 acre anchorage	30.0	64.0	0.47	None

Summary of Public Coordination

Close coordination with the town of Plymouth, the Commonwealth of Massachusetts Division of Waterways, local officials, fishermen and recreational boat owners was initiated and maintained during the reconnaissance and feasibility studies. All concerned parties have been kept informed of the project status during the detailed study phase by individual contact during harbor usage surveys.

V. CONCLUSIONS


The annual benefits of the anchorages considered do not outweigh the annual costs for each alternative examined. While the alternatives examined in this study are engineeringly feasible, the analysis indicated there is insufficient economic justification to permit Corps involvement at this time in the implementation of navigation improvements proposed under these alternatives.

VI. RECOMMENDATIONS

Based on the foregoing conclusions, I find that Corps of Engineers participation in navigation improvements in Plymouth Harbor, Massachusetts is not warranted at this time.

In the absence of Federal implementation of a navigation improvement project in Plymouth Harbor under the Section 107 authority, the town is encouraged to maintain its moratorium on the number of available moorings and to continue to pursue harbor improvement plans in the interest of efficiently managing the harbor. Such management measures would preserve the economic vitality of Plymouth Harbor, enhance the economic efficiency of the commercial fishing operations based in the harbor and the quality of the recreational experience for all harbor users.

Date 19 April 1990


Daniel M. Wilson
Colonel, Corps of Engineers
Division Engineer

APPENDIX A

ECONOMIC ANALYSIS

Plymouth Harbor, MA
Economic Analysis
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Methodology

The purpose of this study is to identify and evaluate the economic impacts of providing additional anchorage area to Plymouth Harbor in Plymouth, MA. The location of the project area and the proposed project are shown in Map 1.

All benefits and costs are stated in their December, 1989 prices, and are converted to their present value equivalent based on the federal interest rate of 8 7/8%.

Economic Study Area

Plymouth harbor is a harbor of significant recreational, commercial, and historic importance. The harbor contains a state pier, a private pier owned by a private marina with slips for recreational boats, federal and state anchorage areas, federal channels, and a Corps breakwater. There are three fish wholesalers in Plymouth, Mayflower Seafoods and Reliable Fish Company, both located in the town Wharf area, and The Lobster Pound, located at Manomet Point. Several restaurants in Plymouth buy direct from the fishermen, selling to the large number of tourists who visit the Plymouth area. Most of the fish caught by fishermen of Plymouth Harbor is sold to Plymouth tourists, making a self-contained market. When the Plymouth catch is insufficient for this local market, retailers buy fish from other nearby harbors to supplement the Plymouth catch. When there is excess Plymouth catch, the fish is sold to Boston markets.

Existing Fleet

There are nearly 700 boats in the harbor, of which 600 are recreational boats, 66 are commercial fishing boats, and 10 are party/tour boats. Of the 66 commercial fishing boats, there are 25 draggers and 41 lobster boats. The draggers berth at the town wharf and the lobster boats moor in the anchorage area. The draggers average 55 feet long with a loaded draft of 8 feet, and the lobster boats average 35 feet long with a loaded draft of 4.5 feet. The commercial fishing boats in Plymouth Harbor are primarily day boats, although approximately 1/3 of the draggers and several of the lobster boats stay out for several days to up to two weeks at a time. Of the 600 recreational boats, 500 are at moorings in the existing federal and state anchorage areas, and 100 are at slips at the private marina. The recreational fleet has a power-to-sail ratio of 60/40, with boats an average of 25 to 28 feet in length.

Existing Conditions

The primary problem in Plymouth Harbor is insufficient anchorage area. The existing state and federal anchorage areas are full to capacity, and there is a waiting list for a mooring in the harbor of 409 boats. Current demand for protected mooring space in Plymouth Harbor, as well as in nearly all

Massachusetts harbors, far exceeds existing supply. There are no other significant problems in the harbor. The harbor is easily accessible by the existing federal channels, is well protected by the Corps breakwater, and is not overly congested or crowded since boat owners are denied moorings and put on the waiting list instead of being fit in to an already full anchorage area.

The 1979 Reconnaissance report cited overcrowding and congestion as the primary problems in Plymouth Harbor. However, according to the harbormaster, there are currently no significant problems with congestion or overcrowding, and no significant delays or damages resulting from overcrowding in the existing anchorage areas. Instead, insufficient anchorage area is only a problem for those 409 recreational and commercial boats on the waiting list.

There are twenty-one commercial vessels on the waiting list for a mooring in Plymouth Harbor. These vessels are primarily lobster and tuna boats. Eight of the twenty-one vessels on the waiting list live in Plymouth or the immediate Plymouth area and would most prefer to moor in Plymouth Harbor but, due to the lack of anchorage area, moor in Sandwich, MA or Marshfield, MA, causing them extra driving time and additional fuel expense. Thirteen of the twenty-one commercial vessels on the waiting list anchor in the naturally existing channel in the east section of the harbor called Hob's Hole Channel, shown on Map 1. Hob's Hole Channel is very narrow and long, with depths in the channel ranging from 9 to 14 feet but bordered on all sides by much shallower areas 1 to 2 feet deep. In strong winds, boats swing on their anchor out of the deep channel into the shallow area, bumping or grounding out, occasionally incurring damages. Also, access to the natural channel is limited at low tide, causing tidal delays to both in-going and out-going vessels.

There are nearly 400 recreational boats on the waiting list for a mooring in Plymouth Harbor. Recreational boaters waiting for a mooring at Plymouth currently either have moorings in other harbors or trailer their boats.

Without Project Condition

The without project condition is equal to the existing conditions. Commercial fishing boats will continue to anchor in the natural channel area, and fishermen will continue to drive to other harbors where anchorage area is available. There will continue to be a long waiting list for commercial and recreational vessels to get a mooring in the harbor.

With Project Condition

The with project condition is the dredging of new anchorage area southeast of the existing breakwater and 18' federal channel. Two different size anchorages were examined to

determine the size anchorage area which maximizes net annual benefits. Alternative 1 is a 10 acre anchorage, -8 feet mean low water (mlw). Alternative 2 is a 5.5 acre anchorage, -8 feet mlw. For the purpose of determining which plan optimizes net annual benefits, it is assumed that the Alternative 1 will accomodate all 21 commercial vessels on the waiting list, both those that moor in Hob's Hole Channel and those that travel to other harbors, and that Alternative 2 will accommodate the 13 commercial vessels on the waiting list which currently moor in Hob's Hole Channel.

Calculation of Benefits

Benefits attributable to providing anchorage area in Plymouth Harbor are calculated based on information provided by the Plymouth Harbormaster and information provided by the Plymouth fishermen in a written survey. Labor time savings for the fishermen are calculated using the August, 1989 average hourly wage of \$9.49 for a manufacturing production worker in Brockton, MA, the nearest city to Plymouth. Based on discussions with the Plymouth harbormaster, this analysis assumes that Plymouth fishermen fish an average of 6 days a week, 9 months of the year (36 weeks), and that each lobster boat has 1 to 2 crewmen, for an average of 1.5 crewmen per boat.

COMMERCIAL BENEFITS TO PROVIDING ANCHORAGE AREA

1. Elimination of Grounding Damages to Lobster Boats Currently Moored in Hob's Hole Channel:

Based on discussions with the Harbormaster and Corps studies in similar harbors, it was estimated that 7 of the 13 lobster boats mooring in Hob's Hole Channel are likely to experience grounding damages in any given year, and that these damages will likely average \$500 per boat per year. The annual benefit for the elimination of grounding damages equals: the number of boats damaged (7); times yearly cost of damage per boat (\$500); or \$3,500.

$$7 \text{ boats} \times \$500 \text{ damage/boat} = \$3,500.$$

2. Labor Time Savings by the elimination of Tidal Delays to Lobster Boats Currently Moored in Hob's Hole Channel:

Based on discussions with the harbormaster, it was estimated that 9 of the 13 boats moored in Hob's Hole Channel currently experience tidal delays, and that these delays last an average of 2.5 hours each. The annual benefit for the elimination of these tidal delays equals: the number of boats experiencing delays (9); time the number of hours per delay (2.5); times the number of delays per month (8); times the number of months fished per year (9); times the average number of

crewmembers per boat (1.5); times the hourly wage for fishermen (\$9.49); or \$23,061.

9 boats X 2.5 hr X 8 delays X 9 mths X 1.5 men X \$9.49 = \$23,061

3. Fuel Cost Savings by the Elimination of Tidal Delays to Lobster Boats Currently Moored in Hob's Hole Channel:

It is estimated that the lobster boats burn 4 gallons of fuel per hour while idling and maneuvering during the tidal delays. The annual benefit for this fuel savings equals: the number of boats experiencing tidal delays (9); times the number of hours per delay (2.5); times gallons of fuel consumption per hour (4); times the number of delays per month (8); times the number of months fished per year (9); times the price of gasoline per gallon (\$1.05); times the percentage of delays experienced while attempting to enter Hob's Hole Channel (50%) (vessels would not burn fuel while waiting to exit the channel as they would be moored without the engine running - it was assumed in this analysis that 50% of the delays would occur while attempting to enter the channel, 50% while attempting to exit); or \$3,402.

9 boats X 2.5 hrs X 4 gal X 8 delays X 9 mths X \$1.05 X .5 = \$3,402

4. Over-land Travel Time Savings to Boats Currently Moored in Other Harbors:

Based on information provided by the harbormaster, the proposed anchorage area would eliminate 40 minutes round trip (0.667 hour) excess travel time for the 8 Plymouth fishermen who currently moor their boats in Sandwich, MA or Marshfield, MA but would prefer to moor in Plymouth. The annual benefit for the elimination of this travel time, based on information provided by the harbormaster, equals: the number of lobster boats currently moored in other harbors (8); times the average number of fishermen per boat (1.5); times the travel time saved per fishing day (0.667 hour); times the number of days per week lobstermen fish (6); times the number of weeks per year lobstermen fish (36); times the hourly wage for fishermen (\$9.49); or \$16,407.

8 boats X 1.5 men X .667 hr X 6 days X 36 wks X \$9.49 = \$16,407

5. Over-land Transportation Cost Savings to Boats Currently Moored in Other Harbors:

The proposed anchorage area would reduce the fishermen's automotive fuel and maintenance costs by

eliminating the need for them to drive the extra 20 miles round trip per day to moor in Sandwich or Marshfield. This analysis assumes that the lobster boats with 2 crewmen would drive together in one car from Plymouth to the other harbor. The annual benefit for these transportation cost savings equals: the number of Plymouth lobster boats currently moored in Sandwich or Marshfield (8); times the number of fishing days per week (6); times the number of fishing weeks per year (36); times the number of miles traveled to be reduced (20 miles); times the current government rate for per mile reimbursement of private automotive travel (\$.24); or \$8,294.

$$8 \text{ boats} \times 6 \text{ days} \times 36 \text{ wks} \times 20 \text{ miles/day} \times \$.24 = \$8,294$$

TOTAL COMMERCIAL BENEFITS = \$54,664

Annual Benefits for Each Alternative Examined

Plan 1, the 10 acre anchorage, would accommodate all 21 commercial vessels on the waiting list. Total annual benefits for plan 1 thus equal \$54,664, the total commercial benefits.

Plan 2, the 5.5 acre anchorage, would accommodate the 13 commercial vessels currently moored in Hob's Hole Channel. Total annual benefits for Plan 2 equal \$29,963, the sum of the benefits in categories #1, #2, and #3, above.

Economic Summary and Conclusion

In order for a proposed project to be considered economically justified, the benefit-cost ratio must be equal to 1 or greater. The annual benefits, annual costs, benefit-cost ratio, and net annual benefits of each plan are shown below in Table 2. Detail on project costs is contained in the main report and the engineering appendix. The annual costs shown below are annualized first costs and do not include annual operation and maintenance costs.

APPENDIX B

PERTINENT

CORRESPONDENCE



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

November 20, 1989

Planning Division
Impact Analysis Branch

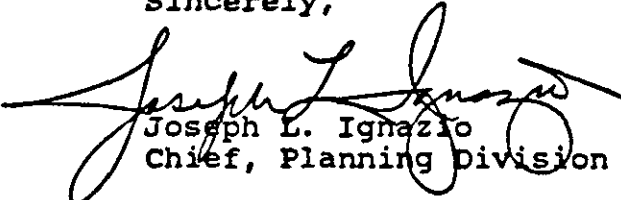
Dear Sir,

The town of Plymouth has requested the Army Corps of Engineers to examine the feasibility of providing additional anchorage area to Plymouth Harbor. Your name was given to the Corps by the Plymouth harbormaster as one of a group of eight fishermen who have recently been denied mooring space in the harbor and who thus would particularly benefit from additional anchorage area.

Please fill out the attached survey form. Your answers will greatly aid the Corps study. Please return the completed survey to Mr. Ralph Savery, Plymouth Harbormaster, who will forward it to the Corps.

Thank you very much for your time and assistance.

Sincerely,


Joseph L. Ignazio
Chief, Planning Division

Attachment

W

Mr. Joseph L. Ignazio,

Dear Sir,

I am one of a small group of individuals who make up a great segment of the fishing community of Massachusetts. We are better known as meat fishermen, unorganized and unrecognized. In my career as a fisherman a lifestyle which I greatly appreciate, (over)

I have tried many types of fishing;
At one time I was aborigine on a 147' dragger
It didn't like due to the waste of fish caught
and thrown back dead to their lack of size,

I had a career as a gill netter which again
I saw a great waste of resources due to by product
killing. I went into business lobstering which I enjoyed
and flourished only to be terminated by state
regulations. (I wasn't in the country in 1979 when a
moratorium on liss. was issued.) I have never
been able to get my liss. back.

In 1980 I turned to charter fishing, I again prospered
I was able to provide a constant income for my
family, put my family into a better life style.

I was able to practice conservation of a appreciated
source. In 1984 my business was ripped from
my grasp. Not due to a lack of business since
not due to a lack of clients. But due to a lack
of mooring spaces. I've lived in Massachusetts ^{all} of
my life, I've lived in Plymouth since 1971. I've fished
the Cape waters since the 60's. I moved to this community
to fish these waters as a choice; I picked this life
style as one which I enjoy and prosper!

What I need now is a mooring space, space
so I can go back into business, space to flourish
again. Mr. Ignazio, put me back on the tax roll
put me back into business, only your department
can get me rolling again.

Sincerely yours.

James A. Bell

Plymouth Harbor
Commercial Fishing Survey for Additional Anchorage Area
November, 1989

1. Name: JAMES G. BELL, 52 PETER RD. PLYMOUTH, MASS. 02360
2. Type of vessel: (lobster boat, tuna boat, etc.)
Combining - fin fish (BASS, BLUES, TUNA) SUMMERS, SPRING + FALL
3. Length: 35' COD, POLLOCK, FLAKE, HALLBUT.
4. Loaded Draft: 3'

5. In what harbor do you currently moor your boat?

UNABLE TO SECURE MOORING SPACE IN THE CAPE COD BAY AREA.
HAVE BEEN PUT OUT OF BUSINESS SINCE 1984

6. In what ways would having your own mooring in Plymouth Harbor benefit your fishing operations?

FROM 1976 TO 1984 I RAN A PROFITABLE FISHING BUSINESS, LOBSTERS AND FIN FISH. I EMPLOYED TWO EMPLOYEES - PROVIDED BUSINESS FOR A LOCAL MARINA (REPAIRS + STORAGE) FUEL BILL APPROX \$6000 PER YEAR. SUPPLIED APPROX. 350 CLIENTS TO LOCAL MOTELS. 1500# PER YEAR IN FISHING Tackle PURCHASES TO LOCAL VENDORS. STATE AND FEDERAL TAXES. DUE TO A SCARCITY IN MOORINGS I HAVE BEEN PUT OUT OF BUSINESS. STARTED OUT WITH A 20' BOAT AND 20 HP AND A HAND FULL OF PLAYS, MADE ENOUGH MONEY SOONER TO BUY A 16' BOAT MOTOR AND TRAILER. HAVE ENOUGH MONEY WITH THOSE TO BUY A 26' BOAT. MADE ENOUGH MONEY WITH THAT TO PURCHASE A 35' BOAT. I NOW HAVE NO WAY TO MOOR THIS BOAT WITHOUT MOORING SPACE I AM OUT OF BUSINESS FOR GOOD.

7. How many months per year do you fish? 8 months

8. How many days per month do you fish? 30 days, weather permitting

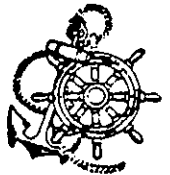
9. What do you primarily fish for? (lobster, finfish, etc.)

UP TO 1979 I FISHED EXCLUSIVELY FOR LOBSTERS, WITH A SMALL PERCENTAGE OF STEPPERS TO FILL IN DURING MOLLUSK TIMES. ANOTHER SMALL PERCENTAGE OF BLUES USED FOR BAIT WITH THE BODIES GOING TO LOCAL RESTAURANTS - I BELIEVED I SUPPLIED THE GREATEST VOLUME OF BLUES LOCALLY THAN ANYONE ELSE IN MY AREA. DURING THE WINTER MONTHS I SERVED AS AN ENGINEER IN THE U.S. MERCHANT MARINE. IN 1979 THE STATE OF MASSACHUSETTS CHANGED THE RULES ON ISSUING COMMERCIAL LOBSTER LIC. AND BEING OUT OF THE COUNTRY ON A U.S. MILITARY SEALIFT TANKER THAT WINTER I LOST MY LIC. (COMMERCIAL LOBSTER). ALL THOUGH TOLD I COULD GET MY LIC. BACK THROUGH A HANDSHIP CLAIM OR ENTER IN THEIR WAITING



TELEPHONE
746-9731

TOWN OF PLYMOUTH
MASSACHUSETTS
OFFICE OF
HARBOR MASTER



Ralph Savery
HARBOR MASTER

August 24, 1989

Mr. Robert S. Russo
Project Engineer
US Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-8557

Dear Mr. Russo:

This letter is a response to our meeting on Aug. 23, 1989. The following is a list of commercial boat owners that have applied for a deep water mooring since the original list of 14 boat owners was sent you on Feb. 6, 1989. In addition to those boat owners there are many that would upgrade to a larger vessel if mooring space were available.

The commercial lobster fishing fleet in Plymouth has almost doubled in the last ten years. Lobster fishing in this area has been at an all time high for the past several years and looks like it will continue.

As I stated at our meeting, I would reserve this new mooring area for commercial vessel's only if legality possible.

List of new applicants for moorings:

James Bell
52 Peter Rd.
Ply., MA 02360
31' Tuna boat

John T LeBica
9 Whiting St.
Ply., MA 02360
22' lobster boat

David Hobson
117 Clifford Rd.
Ply., MA 02360
31' Tuna boat

Robert Duseau
96 Park Ave.
Weymouth, MA
34' lobster boat

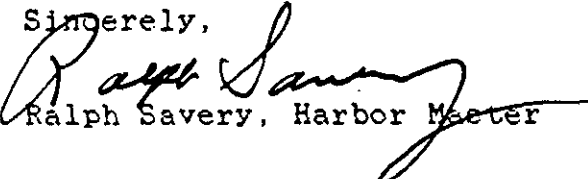
Floyd F. Griffin
44 Highland Terr.
P.O. Box 951
Manomet, MA 02345
35' commercial fishing boat

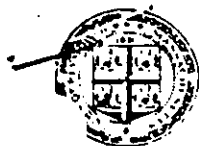
Paul Balboni
45 West Pd. Rd.
Ply., MA 02360
23' or larger lobster boat

Ply. Harbor Mooring Serv.
P.O. Box 1224
Ply., MA 02360
35' work boat

I sincerely hope this information will help in the implementation of much needed dredged mooring space in Plymouth. If this project could be linked to the proposed maintenance dredging of Plymouth Harbor I am sure the Corps would save thousands of dollars.

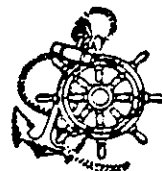
Sincerely,


Ralph Savery, Harbor Master



TELEPHONE
746-9731

TOWN OF PLYMOUTH
MASSACHUSETTS
OFFICE OF
HARBOR MASTER



Ralph Savery
HARBOR MASTER

February 6, 1988

Mr. Charles Joyce
Corps of Army Engineers
424 Trapelo Rd.
Waltham, MA. 02254-9149

Dear Mr. Joyce:

This is a list of commercial boat owners that are waiting for a mooring in Plymouth harbor. Some have moorings in an area that is not dredged and some distance from the shore.

Mr. Rosco Holmes , Plymouth--36 ft. Lobster boat.
Tel: 224-7839

Mr. Alfred Costa , 72 Cherry St., Ply., MA.--36 ft. L/B.
Tel: 747-3794

Mr. Edward Cook , 283 Black Cat Rd., Ply., MA.--32 ft. L/B.
Tel: 747-0985

Mr. David Holmes , Russell Mills Rd., Ply., MA--36 ft. L/B
Tel: 747-0174

Mr. Scott Elliott , 315 Long Pond Rd., Ply., MA.--40 ft. L/B
Tel: 746-7576

Mr. Joe Furtado , Pleasant St., Kingston, MA.--40 ft. L/B
585-4529

Mr. Al Fugazzi , Long Beach, Ply., MA.--38 ft. L/B Tel: no
phone

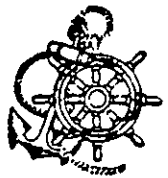
Mr. Philip Torrance, 5 Wenham Shores Dr., Carver, MA.--38 ft.
L/B Tel: 866-2160

Mr. Seth Oehme, River St., Ply., MA.--32 ft. L/B Mother's
Tel: 746-2703



TELEPHONE
746-9731

TOWN OF PLYMOUTH
MASSACHUSETTS
OFFICE OF
HARBOR MASTER



Ralph Savery
HARBOR MASTER

Mr. Charles Joyce
Corps of Army Engineers
February 6, 1988
Page 2

Mr. Wayne Nickerson, Briarwood Ln., Kingston, MA.-36 ft. L/B.
Tel: 585-3133

Mr. Paul Stasis, 204 Indian Ave., Manomet, MA.--30 ft. L/B.
Tel: 224-7055

Mr. Charles Harrington, 52 Arlington Rd., Ply., MA.
Tel: 224-4994

Mr. Charles J. Stuart, P>O>Box 1227, Ply., MA.--40 ft. C/B.
Tel: 585-8659

Mr. Rodman Nickerson, Russell Mills Rd., Ply., MA.
Tel: 746-0373

I hope this list will help in the implementation of the
proposed project to provide much needed mooring space for
Plymouth's commercial fishing fleet.

Sincerely,

Ralph Savery
Ralph Savery, Harbor Master



WILLIAM R. GRIFFIN
EXECUTIVE SECRETARY

TOWN OF PLYMOUTH
OFFICE OF
THE SELECTMEN
11 Lincoln Street
Plymouth, Massachusetts 02360
(617) 747-1620

SELECTMEN
BRUCE M. ARONS
GEORGE W. BUTTERS
WILLIAM F. NOLAN
ALBA C. THOMPSON
DAVID F. MALAGUTI, *Chairman*

March 17, 1988

Charles Joyce
Department of the Army
N.E. Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Dear Mr. Joyce:

I am writing to inform you that the Board of Selectmen strongly supports the request of Plymouth's Harbor Master, Ralph Savery, to keep active the proposed dredging project of a seven acre mooring area in Plymouth Harbor. It is the understanding of the Board of Selectmen through Mr. Savery that at least 50% of the boats that would be moored in this area would be commercial boats. It is very clear that commercial fishermen would greatly benefit from the creation of this mooring area, and in light of that fact, the Board of Selectmen would request that the project not be terminated but rather pursued with all speed possible.

Thank you for your time and consideration.

Very truly yours,

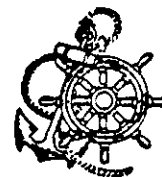

William R. Griffin
Executive Secretary

cc Ralph Savery



TELEPHONE
746-9731

TOWN OF PLYMOUTH
MASSACHUSETTS
OFFICE OF
HARBOR MASTER



Ralph Savery
HARBOR MASTER

December 11, 1987

Mr. Thomas A. Rhen
Colonel, Corps of Engineers
Division Engineer
424 Trapelo Rd.
Waltham, Ma. 02254-9149

Dear Mr. Rhen:

This letter is in response to your letter dated Nov. 2, 1987 and my recent phone conversation with Mr. Charles Joyce.

Plymouth's deep water mooring areas are at capacity and have been for several years. The proposed 7-acre mooring area would benefit commercial boats now moored in areas that are not protected and are some distance from shore. There are several commercial boats that are waiting for mooring space in Plymouth and more applying every year.

There would be at least 50% commercial boats in the proposed mooring area and possibly many more. I would like the opportunity to discuss this project with the Corps before you terminate the study.

Sincerely,

Ralph Savery, Harbor Master

RCS/r

cc: William R. Griffin

APPENDIX C

ENVIRONMENTAL

SAMPLING & TESTING

Enclosed are the results of physical testing performed on sediment cores taken from five locations ("A - E") within Plymouth Harbor, Massachusetts on 9 January 1990 by New England Division Corps of Engineers, Environmental & Materials Laboratory personnel.

The cores ranged in length from 1.05 ft. to 1.8 ft.. They were removed from the plastic liners and visually classified. Each core was then composited for grain size analysis. The sediment ranges from predominantly dark brown silty sand (fines-32%) to dark brown silt with sand (fines-82%). The 0.0 to 0.5 ft. depth range of each core contained darker colored sediment than in the lower depth ranges. Sandier material was found in the depth ranges below 0.5 ft., according to the visual classification logs.

The 1990 test results were compared to data obtained in 1972 and 1983 from testing performed on samples taken from locations within the Federal Channel that were in the vicinity of the present work (see table). Location "D" was used in the comparison as it was closest to the channel. The sample from 1972 contained considerable finer material than that found in the present work. The 1983 sample was more comparable in the composition to the sample location "D".

Since the material from the harbor bottom is made up of fine graded material it was found to be not compatible with the existing beach material found to the north, the south, or offshore along Long Beach. Therefore, hydraulic dredging and pumping the dredged material is not an acceptable disposal option. In addition there were no upland sites in close proximity to Plymouth Harbor suitable whereby the dredged material could be hydraulically pumped to. The only practical disposal option is to barge the dredged material to the Boston Foul open water disposal site.

27 Sept 49

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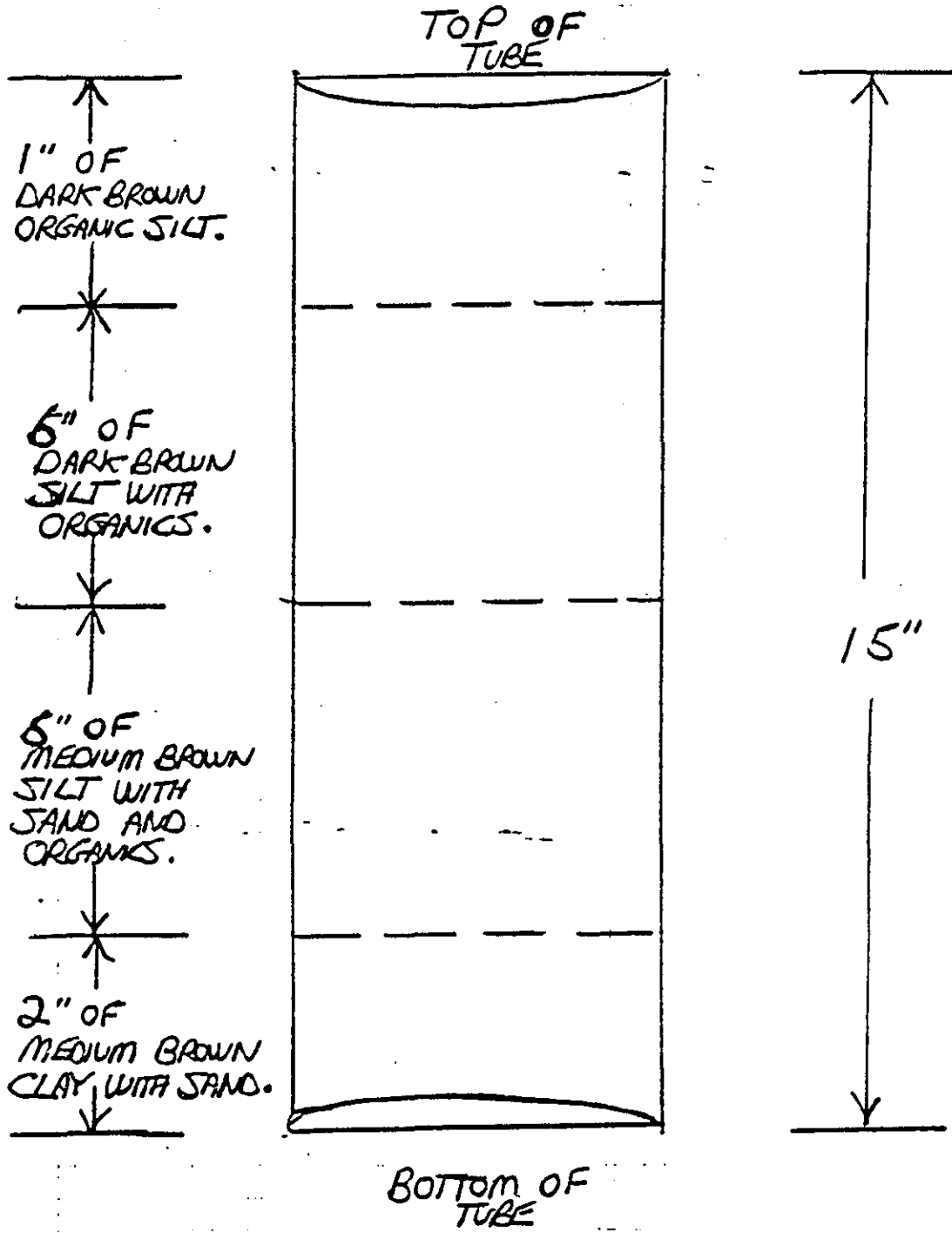
PAGE ① OF ⑤

SUBJECT PLYMOUTH HARBOR, MASS. 100-523-1

COMPUTATION SEDIMENT TUBE SAMPLE "A"

COMPUTED BY J.P.B. CHECKED BY G.P.B. DATE JAN. 17, 1990

* NOT DRAWN TO SCALE.



LABORATORY CLASSIFICATION: SILTY SAND (SM)

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PAGE 2 OF 5

SUBJECT PLYMOUTH HARBOR, MASS. 100-523-2

COMPUTATION SEDIMENT TUBE SAMPLE "B"

COMPUTED BY G.P.B. CHECKED BY G.P.B. DATE JAN. 17, 1990

* NOT DRAWN TO SCALE.

TOP OF
TUBE

6 $\frac{1}{2}$ " OF
DARK BROWN
SILT ~~WITH~~ WITH
ORGANICS.
SOME ODOR.
~~SOME~~

6" OF
MEDIUM BROWN
CLAY WITH SAND
AND ORGANICS.

12 $\frac{1}{2}$ "

BOTTOM OF
TUBE

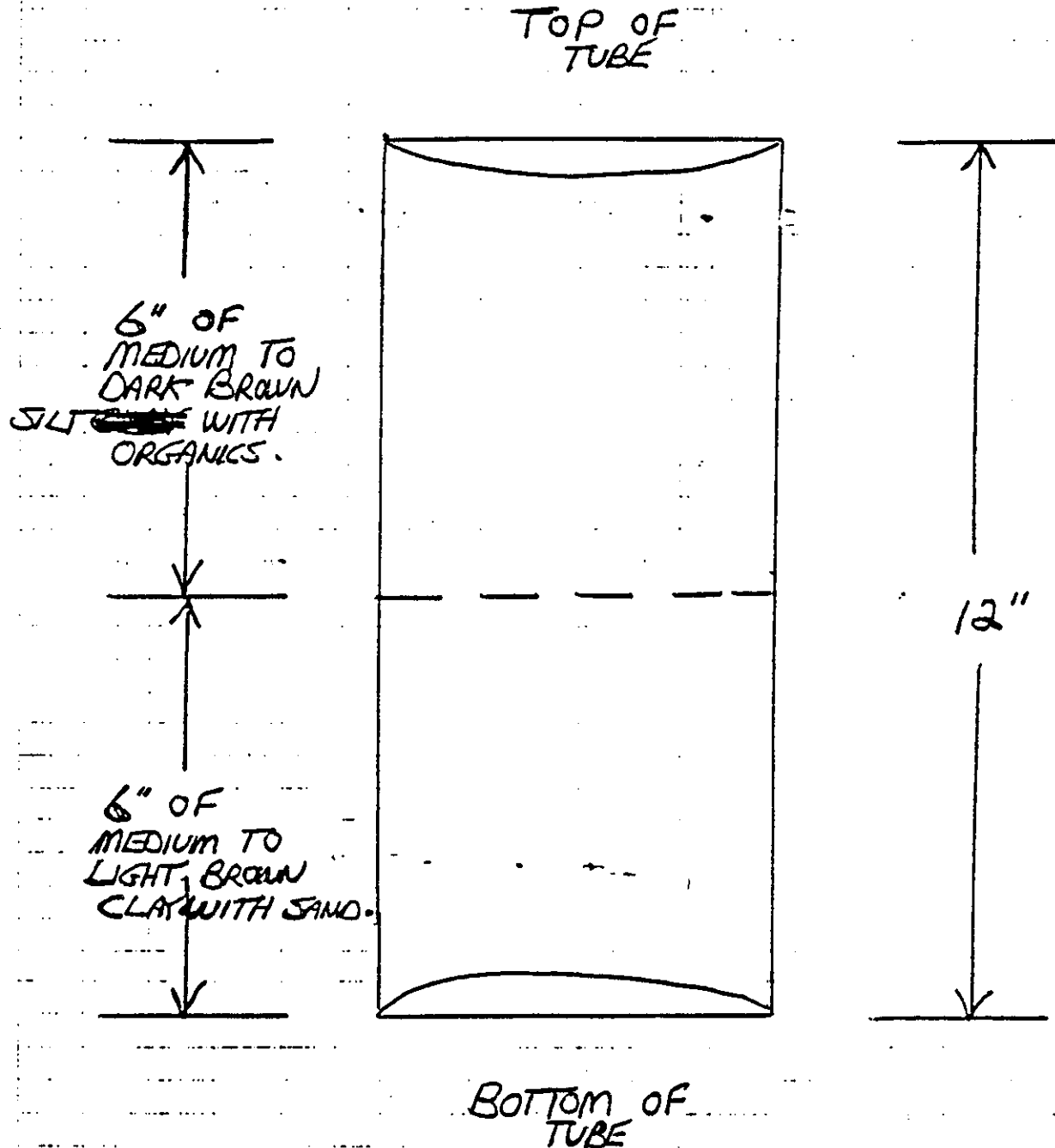
LABORATORY CLASSIFICATION: ELASTIC
SILT WITH SAND (MH)

SUBJECT PLYMOUTH HARBOR, MASS. 100-523-3

COMPUTATION SEDIMENT TUBE SAMPLE "C"

COMPUTED BY JAB CHECKED BY G.P.B. DATE JAN. 17, 1990

* NOT DRAWN TO SCALE.



LABORATORY CLASSIFICATION: SANDY ELASTIC SILT (MH)

27 Sept 49

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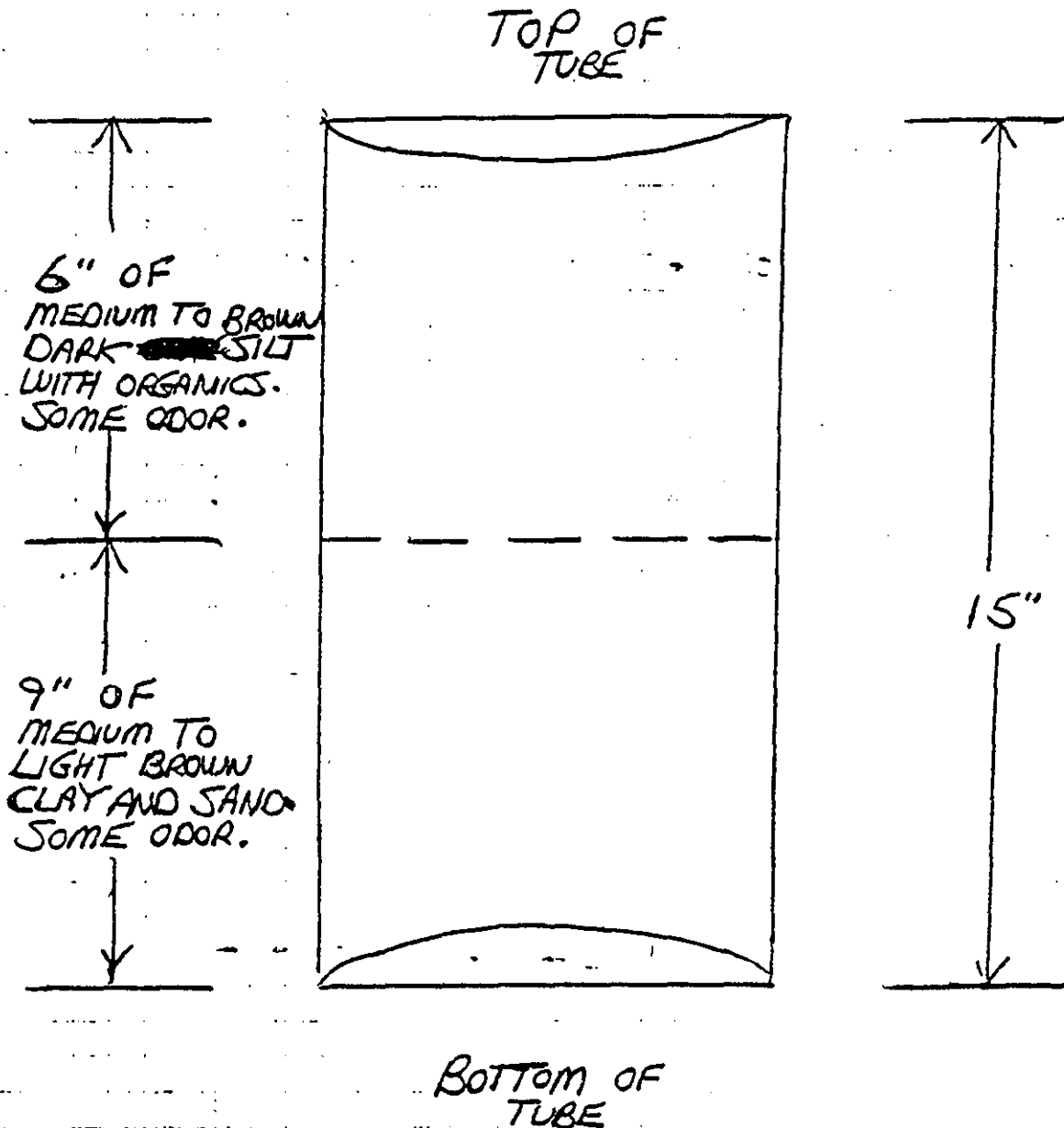
PAGE (4) OF (5)

SUBJECT PLYMOUTH HARBOR, MASS. 100-523-4

COMPUTATION SEDIMENT TUBE SAMPLE "D"

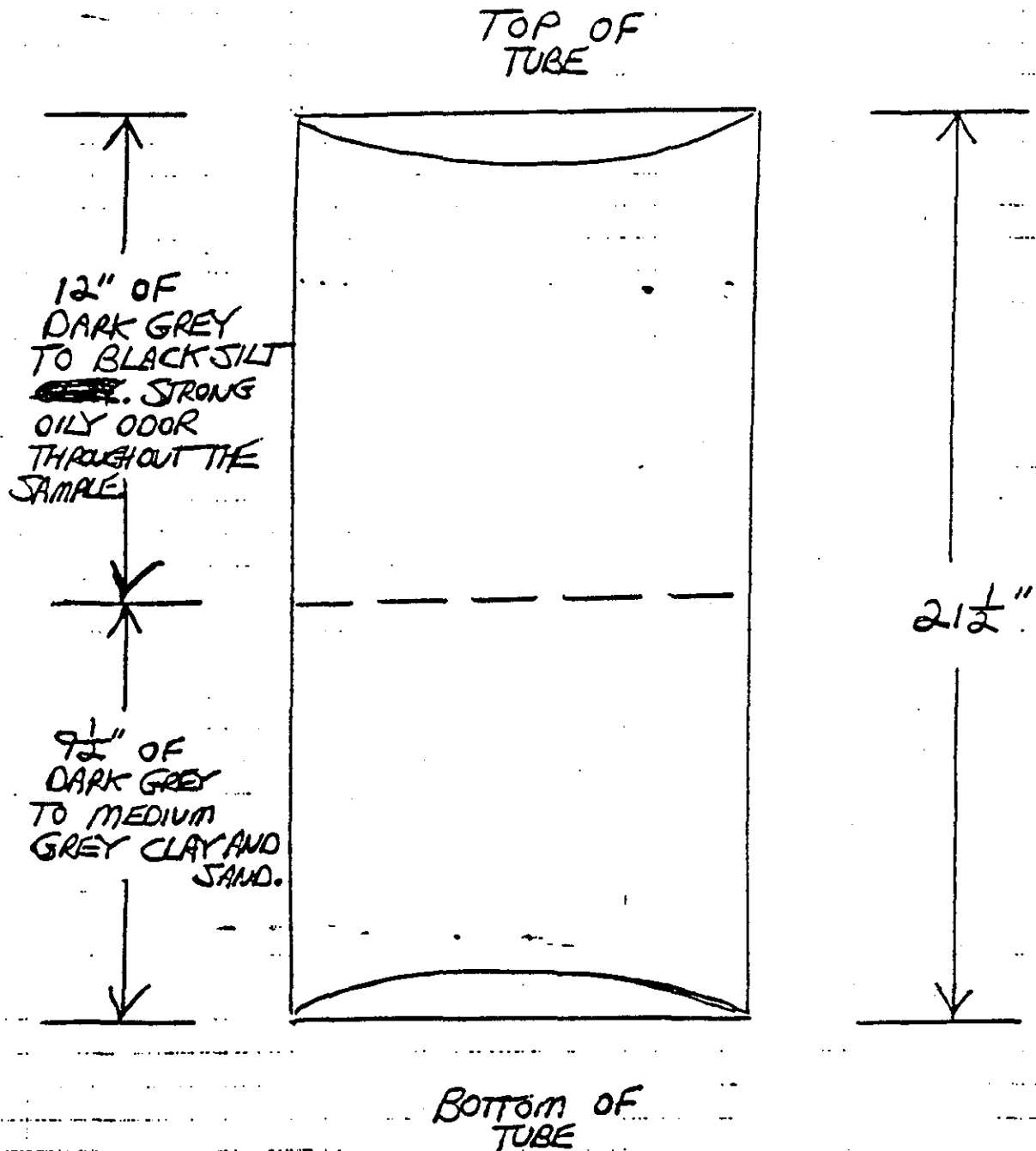
COMPUTED BY G.P.B. CHECKED BY G.P.B. DATE JAN. 17, 1990

* NOT DRAWN TO SCALE.

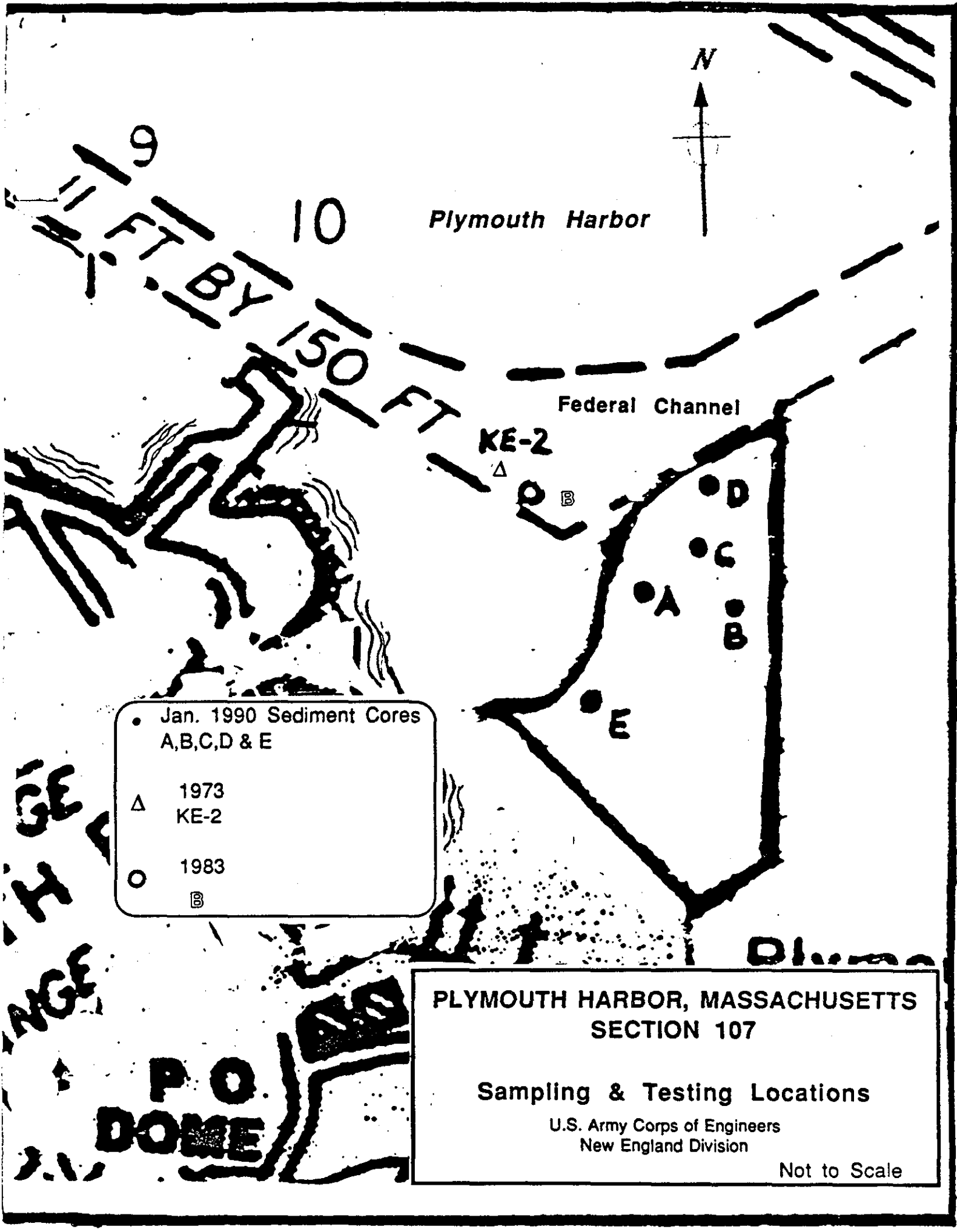


LABORATORY CLASSIFICATION: ELASTIC SILT WITH SAND
(MH)

SUBJECT PLYMOUTH HARBOR, MASS. 100-523-5
COMPUTATION SEDIMENT TUBE SAMPLE "E"
COMPUTED BY JFB CHECKED BY G.P.B. DATE JAN. 17, 1990
* NOT DRAWN TO SCALE



LABORATORY CLASSIFICATION: ELASTIC SILT WITH SAND
(MH)



- Jan. 1990 Sediment Cores A,B,C,D & E
- Δ 1973 KE-2
- 1983 B

PLYMOUTH HARBOR, MASSACHUSETTS
SECTION 107

Sampling & Testing Locations

U.S. Army Corps of Engineers
New England Division

Not to Scale

BOTTOM SEDIMENT SAMPLE TEST RESULTS

(FEEDER)

PROJECT NO. (CC 1-7)		PROJECT TITLE (CC 13-52)		YEAR (CC 53-56)		STATE (CC 57-61)		TIDAL SYS (CC 62-66)		QUAD (CC 67-70)	
90BB239		Plymouth Harbor		1990		NA		MES		PLYM	
	1TH	01	02	03	04	05	1TH				
LAB SERIAL NO.	01	100-523-1	100-523-2	100-523-3	100-523-4	100-523-5	01				
EXPLORATION NO.	02	A	B	C	D	E	02				
SAMPLE NO.	03	1	1	1	1	1	03				
SAMPLE DEPTH (FT)	04	0.0-1.25'	0.0-1.04'	0.0-1.0'	0.0-1.25'	0.0-1.8'	04				
LATITUDE	05						05				
LONGITUDE	06						06				
CO-ORD LOC-NORTH	07	350,370	350,350	350,500	350,670	350,050	07				
CO-ORD LOC-EAST	08	828,700	828,900	828,800	828,850	828,540	08				
SOUNDING	11	9.5'	9.0'	7.5'	7.0'	5.5'	11				
REDUCED SOUNDING-MLW	12	1.5'	2.0'	2.5'	4.0'	3.1'	12				
DATE - HOUR	13	1/9/90:1135	1/9/90:1200	1/9/90:1230	1/9/90:1300	1/9/90:1315	13				
WEATHER	14	0	0	0	0	0	14				
SEA STATE	15	1	1	1	1	1	15				
SECCHI DISC-BLACK	16						16				
SECCHI DISC-WHITE	17						17				
VISUAL CLASSIFICATION BY LABORATORY	20						20				
	21	dark	dark	dark	dark	dark	21				
	22	brown	brown	brown	brown	brown	22				
	23	silty	elastic	sandy	elastic	elastic	23				
	24	sand	silt	elastic	silt	silt	24				
	25	(SM)	with	silt	with	with	25				
	26		sand	(MH)	sand	sand	26				
	27		(MH)		(MH)	(MH)	27				
	28						28				
	29						29				
SOIL CLASS/DOMIN	32	SM	MH	MH	MH	MH	32				
SOIL CLASS/SUB-DOMIN	33						33				
GRAIN SIZE CURVE-MED	34	0.1900	0.0350	0.0600	0.0180	0.0200	34				
GRAIN SIZE CURVE-Q1	35	0.4000	0.0700	0.1300	0.0400	0.04500	35				
GRAIN SIZE CURVE-Q3	36	0.0156	0.0055	0.0115	0.0041	0.0044	36				
GR SIZE CURVE-% FINE	38	32	78	53	80	82	38				
NORMAL/BIMODAL	39	N	N	N	N	N	39				
% H ₂ O	40	64.8	65.9	69.8	75.4	116.8	40				
% Coarse Mat'l (pass >#10 US Std Sieve)	41						41				
	42	1	1	1	1	1	42				
% Medium Sand (pass #10 Sieve retained #40 Sieve)	47						47				
	48						48				
	49	22	4	7	6	4	49				
% Fine Sand (pass #40 Sieve retained #200 US Std Sieve)	50						50				
	51						51				
	52						52				
	57						57				
	58						58				
	59	45	17	39	13	13	59				
	60						60				
	61						61				
	62						62				
	63						63				
	64						64				
PPM ZINC	65						65				
PPM ARSENIC	70						70				
PPM BISMUTH	71						71				
PPM CADMIUM	72						72				
PPM CHROMIUM	73						73				
PPM COPPER	74						74				
PPM IODINE	75						75				
PPM NICKEL	76						76				
PPM PHOSPHORUS	77						77				
PPM SILVER	78						78				
PPM TIN	79						79				
PPM VANADIUM	80						80				
% CARBON (ORGANIC)	85						85				
% CARBON (CARBONATE)	86						86				
% CARBON (TOTAL)	87						87				
% HYDROGEN	88						88				
% NITROGEN	89						89				
PPM BENZENE	90						90				
PPB ODT	91						91				
PPB PLYCHL BIPH	92						92				
CARBON 14 (YAS)	93						93				
RADIOACTIVITY(MR/MR)	94						94				
REMARKS	R1										
	R2										
	R3										
	R4										

* LEGEND:
 LI- LIMIT OF INSTRMT
 NP- NON-PLASTIC
 LT- LESS THAN
 GT- GREATER THAN

Comparison Chart - Plymouth Harbor, 1990

<u>Parameter</u>	<u>1973</u>	<u>1983</u>	<u>1990</u>
	KE-2	"B"	"p"
	0.0-1.5'	surface	0.0-1.25
Classification	organic silt (OH)	grey organic sandy silty clay (OH)	dark brown elastic silt with sand (MH)
% Coarse Material (pass #10 U.S. std sieve)	<1	<1	1
% Medium Sand (pass #10 sieve retained #40 sieve)	<1	<1	6
% Fine Sand (pass #40 sieve retained #200 sieve)	5	2	13
% Fines (silt/clay) (pass #200 sieve)	95	88	80